PROCESS FOR DENITRIFICATION OF EXHAUST GASSES, PARTICULARLY FOR LEAN OPERATED INTERNAL COMBUSTION ENGINES

[0001] The invention concerns a process for denitrification of primarily lean operated internal combustion engines according to the precharacterizing portion of Patent Claim 1.

[0002] EP 0 890 389 A1 discloses an NOx storage catalytic converter for cleansing the exhaust gasses of vehicle exhaust gas systems. The disclosed storage catalytic converter is comprised of two material components, wherein the one material component serves for intermediate storage of nitrogen oxide during lean operation of the vehicle internal combustion engine and the other material component is a catalytic material with three-way characteristics in which, during short term rich exhaust gas operation, stored nitrogen oxide is released and converted to molecular nitrogen (N_2).

[0003] The required relationship between the lean operating phase and the rich operating phase in the combustion control of the vehicle internal combustion engine is determined by various parameters such as the NOx storage capacity of the material, the amount of NOx arriving, the exhaust gas temperature and, in the case of sulfur-containing exhaust gas, by the sulfur content. In order to achieve a low fuel consumption, it is desired to operate the vehicle internal combustion engine as long as possible with lean operating phases and as briefly as possible with rich operating phases. The NOx storage catalytic converter thus operates discontinuously, since the combustion control of the exhaust gas must be switched alternatingly from lean to rich.

[0004] EP 0 707 882 A1 discloses an NOx storage catalytic converter with an aluminum oxide containing carrier, upon which a

the rich motor operating phase in comparison to the lean motor operating phase, a lower NOx conversion is achieved.

[0008] It is the task of the invention to provide a process for denitrification of exhaust gasses from primarily lean operated internal combustion engines, which process achieves a good effectiveness even in the case of very short rich motor operating phases.

[0009] The solution to the task is set forth in Patent Claim 1. Further advantageous embodiments of the inventive process are set forth in the further claims.

[00010] In the inventive process the porous carrier substance is comprised of at least 50 wt.% zirconium oxide, titanium oxide, silicon oxide or a zeolite, or a mixture of two or more of these compounds.

[00011] The BET-surface of the above-listed carrier substances is preferably between 10 and 500 m^2/g. The rhodium concentration upon the listed carrier materials is preferably 0.1 to 2 wt.%, but can however be appropriately increased or reduced for targeted changes of the solids characteristics.

[00012] For improvement of the nitrogen oxide storage and catalytic characteristics of the process it is possible to supplementally apply one or more noble metals, for example platinum, iridium or palladium upon the porous carrier substance. Thereby the activity of the material may be significantly increased.

[00013] In an advantageous embodiment of the inventive process the nitrogen oxide storing and catalytically effective solid can, commensurate with the intended use, be employed in various forms

[00015] The inventive process is particularly suitable for employment in internal combustion vehicle motors, and in particular diesel motors, stoichiometrically and lean operated Otto motors, as well as gas motors.

[00016] The invention will be described in greater detail below on the basis of the experimental results with reference to the figures. There is shown:

Fig. 1 the temperature-dependent NOx conversion of an inventive Pt/Rh/ZrO_2-solid in λ-alternating operation,

Fig. 2 the NOx concentration over time using the inventive Pt/Rh/ZrO_2-solid at T=280°C in λ-alternating operation.

[00017] During the experiments a lean operating phase of 90 seconds was alternated with a rich operating phase of 4 seconds. The reaction-gas had the following compositions in the lean and rich operating conditions:

	Lean (λ=2.4)	Rich (λ=0.7)
NO	280 Vol.-ppm	280 Vol.-ppm
O_2	12.5 Vol.-%	0 Vol.-%
CO	0.25 Vol.-%	9.3 Vol.-%
H_2	1500 Vol.-ppm	2.6 Vol.-%
Propene	75 Vol.-ppm	2700 Vol.-ppm
CO_2	10 Vol.-%	10 Vol.-%
H_2O	10 Vol.-%	10 Vol.-%
N_2	Rest	Rest